M. J. THOMSON

Introducing Old Growth
The Ultimate Forest

SOUTHERN ONTARIO WOODLANDS

Old growth forests are diverse places, with young and old trees, decay and new growth, canopy gaps, uprooted trees, large logs, pits and mounds, snags and a diversity of plant and animal species.

Old Growth

(alias ancient forests, climax forests, decadent stands, "first forests", old growth stands, older growth, over-mature stands, primeval forests, pristine forests, virgin forests)

What is an old growth forest? To answer this question, naturalists talk about wildlife and specialized habitat. Foresters refer to big "overmature" trees. Ecologists discuss intricate food webs and distinct soil patterns. Old growth is all of these things and more.

Simply put, old growth or "older growth" forests are relatively old and relatively undisturbed. The dominant trees are beyond their average life span and the forest is mostly free of logging or other human disturbances. So how old are trees in "old growth" forests? The average lifespan of tree species varies: while red oak reaches 200+ years, eastern hemlock can live 600+ years. But old trees alone do not make old growth forests. Old growth forests develop when trees live long *and* die natural deaths, creating a diversity of structures, habitats and ecological conditions.

Common life expectancy of trees in old growth stands

eastern hemlock	600+ years
white pine	450+
eastern while cedar	400+
red pine	350+
sugar maple	300+
yellow birch	300+
white spruce	200+
red oak	200+
black spruce	200+
poplar	150+
jack pine	140+
white birch	80+

Source: Ontario Old Growth Policy Advisory Committee Final Report

Big dead trees, thick rotting logs and forest floor pits and mounds – caused by uprooted trees – are common features of old, unlogged forest. You can find these features scattered in many woodlands, but they reach their ecological peak in old growth stands. Dead trees are larger, fallen logs are bigger, and pit-mound microtopography (bumps and depressions on the forest floor) is more prevalent.

This fact sheet is a simple guide to old growth features of southern Ontario woodlands. It does not define old growth, because each forest has been uniquely crafted by local soils, climate, geology and landforms and is populated by its own collection of plants and animals. Each forest also has a different history of human use. Instead, it guides you to things you can look for in any woodland, to assess its old growth potential. Old growth features can develop "anew" in forests as young as 100 years, while some existing features are remnants of the past. By seeking out old growth features you can learn about what makes old growth special, and why they are important parts of southern Ontario's woodland heritage.

Why do old growth forests and old growth features need special attention?

Old growth is the ultimate forest - it is where nature has taken its course and the forest continues to grow to a fine old age. Old

Federation of Ontario Naturalists

growth was common in the past, even though wildfires, windstorms, disease and other natural forces regularly levelled trees and forests. Today logging is more likely to cut short the life of a forest at a younger age and earlier ecological stage. When a tree is converted to lumber, firewood, paper or other wood products, it is lost from the natural system. But when it dies a natural death in the forest, its body and influence live on. This gives old growth unique qualities that make them stand apart from other woodlands.

Old growth forests have many values

- Habitats for forest species and wildlife communities
- Sources of habitat diversity
- Living examples of how natural forests work
- Sources of inspiration and heritage appreciation
- Resources for education and benchmark sites for scientific research

In some parts of southern Ontario, even young or mature woodlands are uncommon. Very old forests are extremely rare. From swamps to hardwoods to pine forest, no matter where you are, intact older forests and their habitats are threatened. In southern Ontario, less than .07 percent of the land base is in stands older than 120 years.

Old growth forest remnants are also at risk. Elements of old growth – dead trees, logs and soil diversity – that remain in younger forests provide important ecological services and enrich the habitats for wildlife. You can find some ingredients of old growth in almost every forest you explore. But these remnants often do not survive standard logging activities.

The four lives of a tree

In old growth forests, trees have both a life *and* an afterlife. In fact, you could say the trees have four lives–the *young tree*, the *mature tree*, the *dead standing tree*, and the *fallen tree*.

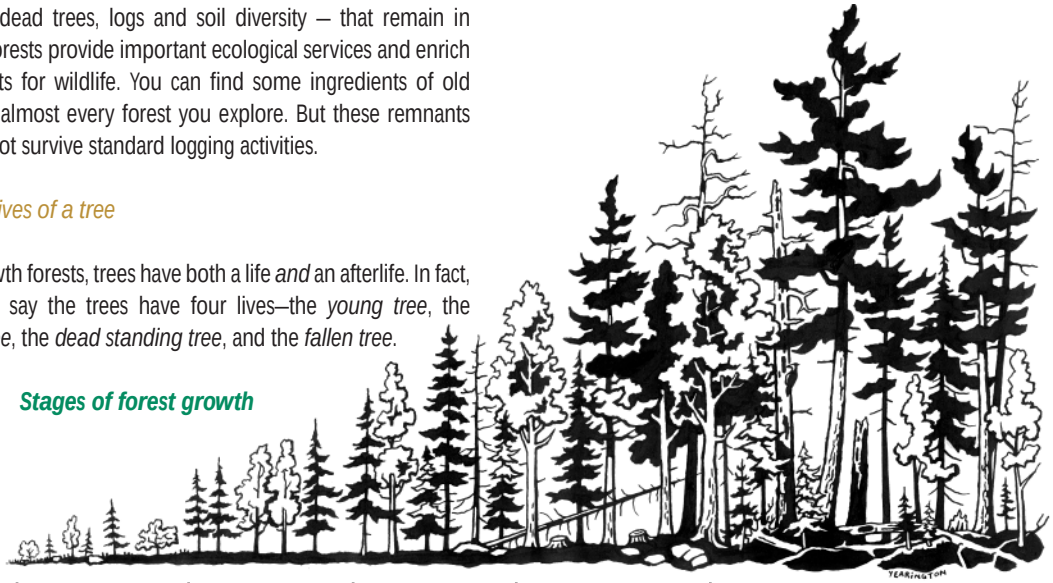
The first life as a sapling and young tree is a struggle to survive and reach maturity. A tree that survives this stage enters its second life as a mature tree. There it finds a place in the forest canopy and may reach its maximum size. Its life may be cut short, however, by fire, lightning, disease, flooding, ice damage, insect attack or other force of nature. Or it may be toppled by wind, rain, snowstorms or gravity. This is when the ecological afterlife begins. Death takes its toll on living trees of all ages. But while death is inevitable, so is the tree's afterlife.

A dead tree is not a dead end because it opens up new worlds of forest life, first as a dead standing tree and then as a fallen log. Dead trees and fallen logs can easily last as long in the forest as when the green tree was "alive," sometimes longer. Large logs, for example, can last over a hundred years on the ground before being completely reabsorbed into the ecosystem.

Dead, dying and decaying trees provide habitat for animals such as osprey, woodpeckers, ruffed grouse and squirrels. This natural debris is also raw material for ecological processes such as nutrient cycling and plant regeneration and is also habitat for wildlife.

Old growth forests are places where you can find all four ecological lives of a tree.

Stages of forest growth



Old growth is the ultimate forest - it is where nature has taken its course and the forest continues to grow to a fine old age.

How does your forest measure up?

Old Growth Forests

- Large and/or older trees
- Canopy has many layers
- Large canopy gaps
- More uprooted trees
- More large dead or broken trees
- Logs and woody debris common
- Streams crossed by large logs and debris
- Undisturbed soil and woody debris means greater water retention and soil retention
- High natural trees species diversity, including understory and herb layer
- Ground hummocky from mounds and pits of old fallen logs and root tip-up mounds
- Trees with few branches to canopy
- Few signs of logging

Younger Forests

- Smaller and younger trees
- Canopy has fewer layers
- Smaller canopy gaps
- Fewer uprooted trees
- Fewer large dead or broken trees
- Logs and woody debris uncommon
- Streams have less large woody debris
- More disturbance and less woody debris means less water and soil retention
- Tree species diversity affected and directed by logging
- Less evidence of old, buried fallen logs or root tip-up mounds
- Tree branches along trunk
- Logged regularly, evidence of logging and logging trails prevalent

Standing Dead Trees

(alias cavity tree, chicot [pronounced sheeko or cheeko], cull tree, dead tree, den tree, hollow tree, roost tree, rotten tree, senescent tree, snag, stub, wildlife tree)

Dead standing trees gradually fall apart, but as they do they provide food, perches and nesting and roosting sites for about one quarter of all forest wildlife species. Great blue herons, bald eagles and osprey nest in dead trees or dead treetops near or above water. Dead trees and branches are prime perches and hunting sites for flycatchers, kingfishers, hawks, eagles and other birds. Woodpeckers seek dry solid dead wood for territorial drumming sites.

Even peeling bark provides an opportunity. Brown creepers wedge plant material into crevices behind decaying bark to create their nests. Several bat species, some insects and even the odd squirrel all roost under loose bark.

Fungi, mosses and bacteria begin the process of decay even before a tree completely dies. Their mechanical and chemical activity breaks down the woody material, paving the way for entry and feeding by insects. Carpenter ants and other insects chew into the wood to form galleries and build nests. These insects then attract pileated, hairy and other woodpeckers. Contrary to some common beliefs, woodpeckers are not a significant cause of tree death; once the woodpeckers start to feed, the trees are already in decline.

A Guide to Dead Trees

Dead trees are vital parts of wildlife habitat, providing food and nest sites as they decay and crumble to the ground. The stages illustrated have been used to study dead trees in forests in different parts of North America.

Deciduous

Decay Class 1 2 3 4 5

Coniferous

Decay Class 1 2 3 4 5

In some parts of southern Ontario, even young or mature woodlands are uncommon. Very old forests are extremely rare.

Field Sign	LIVE TREE with dead and dying branches or broken top	Decay Class 1	Decay Class 2	Decay Class 3	Decay Class 4	Decay Class 5
Tree top	-Broken top or dead stub on tree top	-Tree top intact and just recently dead	-Tree top intact	-Tree top intact	-Top broken off	-Top broken to a stub less than 6 m high
Branches	-Many or most branches still alive -About 25 percent of canopy still dead	-Recently dead -Fine branches still present	-Fine branches gone -Less than half of large branches gone	-More than half of large branches gone	-All large branches gone	-All large branches gone
Bark	-Bark on trunk intact -Bark on branches may be dead	-Bark mostly intact	-Bark loosening	-Bark usually falling off	-Bark nearly gone	-Bark and wood deteriorating
Cavity nesters	-Dead sections may be used by cavity nesters as per decay class -Yellow-bellied sapsucker may already be nesting in tree -Dead parts of tree used as drumming and display sites for woodpeckers -Pileated woodpecker can excavate these living trees	Same as live tree with dead top -Pileated woodpecker (strong excavator, can use this tree)	-Used for nesting and foraging sites for strong excavators like pileated woodpecker	-Nesting site for weaker excavators like downy and hairy woodpeckers	-Used by weaker excavators like the downy woodpecker for nesting sites and then by cavity nesters like flying squirrels	-Used by weaker excavators like the downy woodpecker for nesting sites and then by cavity nesters like flying squirrels -Used by weak excavators like chickadees as well as mice and chipmunks for nesting sites
Other wildlife use	• Waterfront nesting sites for osprey, eagles and herons. Tree top perching and hunting sites for hawks, owls and perching birds. • Dead branches are common perching sites for birds such as eastern phoebe, Acadian flycatcher and hummingbirds. • Used by herons, raptors and perching birds. Birds such as brown creepers nest and bats roost under loose bark.					

This system helps you see the differences in the dead trees around you and learn about their value to wildlife and the forest.

Tree Cavities

(alias dens, hollows, nest holes, roost holes, tree holes, woodpecker holes)

Woodpecker holes and other tree cavities give new life to dead or dying trees. Ducks, flycatchers, warblers, wrens, thrushes, falcons, owls, mice, squirrels, weasels and other species all use tree cavities for nesting, resting, storing food or raising young. A succession of different wildlife species may be tenants in each tree cavity, as the years go by. There are obvious advantages to living in a hole. A tree cavity gives shelter from wind, rain or snow and is a stable environment in which to incubate eggs or raise young. Thick cavity walls also give protection from many predators.

Entrances to active nest or den cavities are usually surrounded by sound wood and are large enough to allow access by the animal but exclude its predators. The holes can be excavated or natural, large or small. You can use binoculars to examine wildlife activity in cavities. Evidence of use includes a smooth, worn or lightly coloured entrance—resulting from repeated brushing by the animal. Look also for gnawing, fur or feathers, a lack of spider webs, or nesting material protruding from the entrance.

Cavity size	Cavity details and dwellers
Small	• 2.5 – 5.5 cm diameter hole • Size of a two-dollar coin to the size of a racquetball • Excavated by downy woodpecker, yellow-bellied sapsucker, hairy woodpecker, black-capped chickadee, boreal chickadee and red-breasted nuthatch • Small holes can be used by tree swallow, white-breasted nuthatch, house wren, Carolina wren, eastern bluebird, European starling and prothonotary warbler • Small dens for deer mouse, eastern chipmunk, red squirrel, northern flying squirrel and southern flying squirrel
Medium	• 5.5 – 10 cm diameter hole • Size of a hardball to the size of a grapefruit • Excavated by northern flicker, red-headed woodpecker, red-bellied woodpecker, black-backed woodpecker and three-toed woodpecker • Medium-sized holes can be used by all small hole-nesters (above), plus wood duck, screech owl, boreal owl, saw-whet owl, American kestrel • Dens for all mammals above, plus grey squirrel
Large	• 10 – 12.5 cm wide and 12 – 20 cm high hole • Size of a paperback novel with rounded edges • Excavated by pileated woodpecker • Large holes can be used by all hole-nesters above, plus common goldeneye, bufflehead, hooded merganser, barred owl • Dens for larger mammals such as grey squirrel, raccoon, American marten
Extra Large	• Round or irregular hole larger than 15 cm wide • Size of a volleyball or larger • Usually created by decay rather than woodpeckers • Tend to be roost sites and escape cavities rather than nests

Use this summary as a guide to wildlife using tree cavities in forests in eastern Canada.

Dead trees are vital parts of wildlife habitat, providing food and nest sites as they decay and crumble to the ground.

The uprooting of a tree is a natural event that adds diversity to forest habitat.

Mounds and Pits

(alias microtopography)

If you removed all the live and dead vegetation from a forest, you would reveal a landscape of craters and mounds. Bedrock and rubble make some of these humps and hollows. But much of this "microtopography," especially in old growth forests, is made by the trees themselves.

Explore recent windfalls. The roots may yank up earth, rock and plant material and create small craters. You can often see this material still stuck in the tangle of roots.

Wind and snowstorms commonly topple trees in every forest. Violent storms and tornadoes can break or uproot entire stands. Wind gusts hitting snow-laden branches may knock down groups of trees. Individual trees with weakened roots or large wind-catching crowns may fall on their own.

Canopy gaps left by uprooted trees are important to forests because they allow sunlight to reach the forest floor. The mounds and pits created over the life of a forest (maybe hundreds or thousands of years) are also important–they add soil diversity and new sites for regeneration. Up to one half of the forest floor could be covered with young and old mounds and pits from uprooted trees. People studying soil find that the backhoe action of the wrenched roots creates complex soil profiles with inverted earth layers.

Look for small craters or hummocks in the forest. They can be as wide as a bed or a small room and up to a metre deep, depending on the size of the tree that fell over. Bowl-shaped pits are likely caused by deep-rooted trees such as pine and hemlock. The presence of some large bowl-shaped pits in a young forest can be evidence of large pine, hemlock or hardwood forests of the past. Shallow pits created by the shallow-rooting species such as spruce, fir and beech are soon obliterated by vegetation growth and soil settling. Larger craters can last a long time.

Trees rarely grow in the bottom of these pits. Leaf litter collects there and may be too deep for small seedlings to penetrate. The edges of mounds and pits, on the other hand, are good rooting sites and trees often get established there, taking advantage of the light-filled gap created by the fallen tree. These pits are rich microhabitats and support higher diversities of insects than the surrounding forest floor.

Second growth forests that grew up on abandoned farmland may not have much mound and pit microtopography. The till and plow would have flattened and mixed up the soil before the land was abandoned. Managed forests may also have lost their natural microtopography through the action of heavy machinery used to prepare cutover areas for planting and tree regeneration. Old growth forests have highly diverse microtopography that creates diverse habitats for plants and invertebrates.

A Guide to Logs

Decay Class 1

Decay Class 2

Decay Class 3

Decay Class 4

Decay Class 5

Decay Class	Form and Shape of Log	Branches	Bark	Wood Moisture and Texture	Plant and Animal Habitat
Decay Class 1	-Tree recently fallen -Form still distinct -Log round and rigid	-May be elevated by branch stubs or ground	-Bark intact	-Solid, rigid tree with dry, hard wood	-Little or no new plant growth on log -Site for grouse drumming and woodpecker foraging
Decay Class 2	-Form still distinct -Log round -Log supports weight of person	-Branches and branch stubs mostly gone	-Bark loose but patches may still remain	-Moist wood, beginning to soften -Log somewhat rigid but sags	-Some new moss, lichen, fungal and algal growth on parts of the log -Grouse drumming and woodpecker foraging site
Decay Class 3	-Log round but sags to conform with ground contours	-No branches	-Trace of bark	-Wood breaks into large hard pieces -Log does not fully support weight of person	-Tree seedlings and flowering plants begin to grow on log -Bear foraging site (ants)
Decay Class 4	-Log round to oval -All of log on ground -Becoming meshed with soil	-No branches	-No bark	-Wood breaks into small, soft and/or moist pieces	-Log soft -Nurse log for tree seedlings -Breeding site for snakes and salamanders
Decay Class 5	-Log rotten and covered with litter -Log oval or flattened -All of log on ground or beneath surface of ground or leaf litter	-No branches	-No bark	-Soft and powdery wood -May not appear as log at first glance	-Nurse log for tree seedlings -Perched trees or seedlings may be only evidence of log -Breeding site for snakes and salamanders

Logs and Down Woody Debris

(alias coarse woody debris, dead wood, drumming logs, fallen trees, nurse logs, plucking perches, rotten logs)

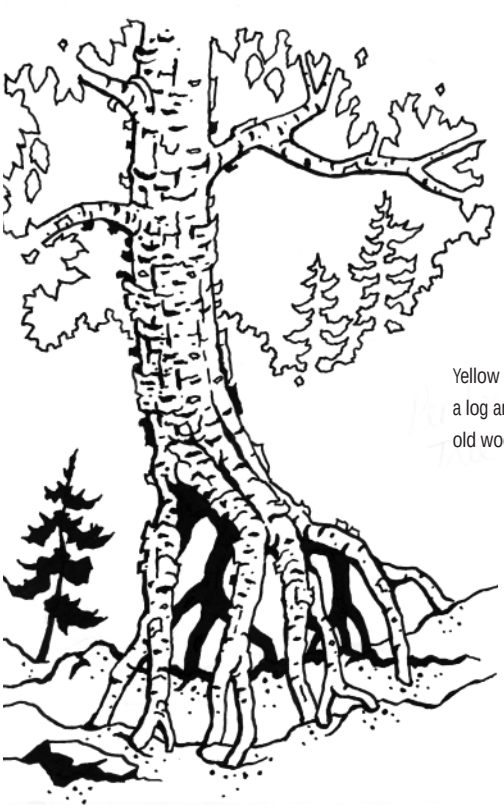
A tree that naturally falls to the ground is not a loss to the forest. The log and the disturbance it creates act more like a boom town.

Like a backhoe, the roots of a wind-thrown tree tear up the ground, exposing pockets of fresh soil throughout the forest. Young trees, shrubs and some wildflowers thrive on the disturbed soil and bask in the new-found light streaming through the gap in the forest canopy. Once fallen trees hit the ground, insects move in. Bark beetles, armed with mandibles that can penetrate the tough outer bark, chew into the protein-rich sapwood. Carpenter ants, which do not eat wood, carve tunnels for their colonies. These insect pioneers pave the way for the next wave of immigrants—fungi, bacteria, and other microscopic animals. Populations of nematodes explode in rotting logs. Nematodes provide a food supply for mites and insects. Higher up the food chain await predators such as pseudoscorpions, salamanders and woodpeckers.

Ruffed grouse use dead logs as stages for their territorial drumming, while northern goshawks – which also prey on grouse – often use logs and stubs to eat their prey.

Old growth forests retain soil moisture within the accumulated logs and woody debris on and beneath the forest floor. A well-decomposed log acts as a stable, moist environment for rooting of many plants. During dry spells, it also provides a water reservoir and nurturing oasis to some animals. Streams in older growth forests often have tumbling cascades that form when water flows over logs, branches and woody debris. The scaled-down waterfalls, rapids and pools create micro-habitats for a diversity of aquatic life. The pools can be refuges for juvenile brook trout of lakes downstream.

As logs get recycled back to the soil, they pass through several stages of decay. Pine logs decay very slowly and may take 100 to 200 years to break down, while poplar and maple decay more quickly. The logs are important to wildlife habitat and the forest at each stage of decay.



Yellow birch trees often start life on a log and remain "perched" when the old wood decays.

Nurse Logs and Perched Trees

Any gardener knows that fibrous material is a good soil conditioner. This also works in forests. Rotting logs eventually form a woody mulch valuable to soil life. Even before this stage, tree seedlings may already get a toehold in the log.

Yellow birch, eastern hemlock, balsam fir, white birch and some other trees take advantage of "nurse logs." Their lightweight seeds have a hard time penetrating thick leaf litter. Old logs, stumps and root mounds are free of deep litter and may protrude above the snow–both assets for some seeds to germinate and start growing.

Logs are a rooting medium but are not a source of all the necessary nutrients. Seedlings, therefore, send small rootlets through the decaying wood to reach the soil. By the time the nurse logs decay and subside, the roots may be strong enough to hold the tree perched off the ground.

You can estimate when a log or stump became rotten enough to become a nurse log by the age of perched trees or saplings growing on top. If perched trees started their lives on stumps, the age of the live tree indicates the stump was created at least that long ago. The age of a perched tree also indicates how long it is taking for the nurse log to decay. A poplar, for example, will rot away quickly while a hemlock remains in place for much longer.

Canopy gaps left by uprooted trees are important to forests because they allow sunlight to reach the forest floor.

Tree seedlings often colonize rotten logs.

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(Copies of Extension Notes are available at no charge from the Eastern Ontario Model Forest, P.O. Bag 2111, Kemptville, Ontario, K0G 1J0)

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The Federation of Ontario Naturalists (FON) protects Ontario's nature through research, education, and conservation action. FON champions woodlands, wetlands and wildlife, and preserves essential habitat through its own system of nature reserves. FON is a charitable organization representing 25,000 members and supporters and 125 member groups across Ontario.

Fact sheets in this series include:
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Introducing Old Growth – The Ultimate Forest
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Woodlands At Risk is a 32-page full colour booklet about the threats to southern Ontario's woodlands, available from FON.

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